LM35 Sensor with STM32F0

In this tutorial, we'll discuss how to interface the LM35 temperature sensor with an STM32F0 microcontroller. Using the ADC to get the analog output voltage of the sensor then converting it back to Celsius degrees, and finally display the result on without using Floating value an LCD 16x2.

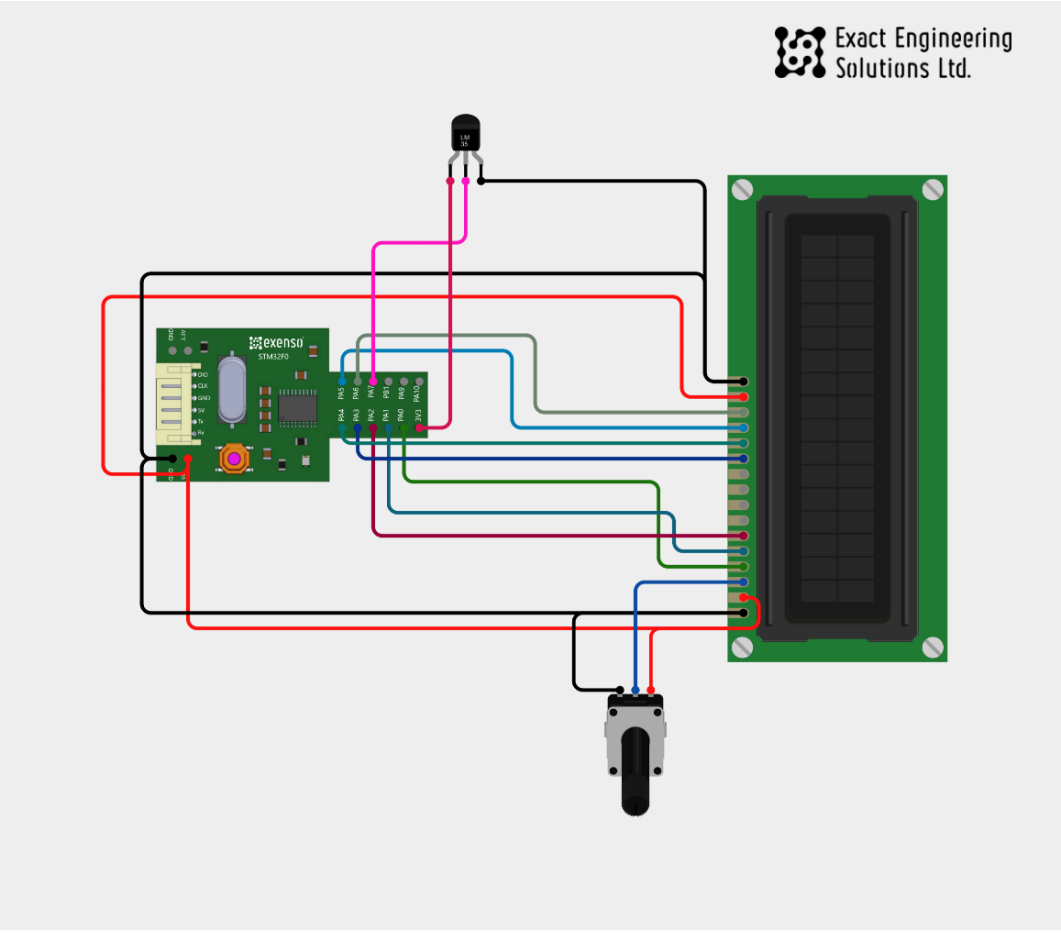
Components Required

You will need the following components −

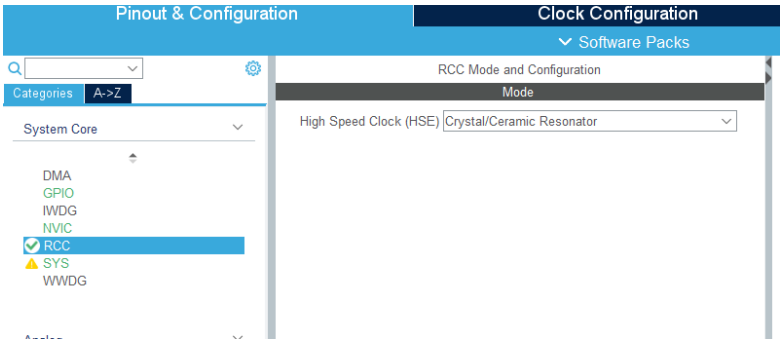
- 1 × Breadboard
- 1 × STM32F030F4P6
- 1× LCD 16x2
- 1× 10KΩ potentiometer
- 1x LM35 Temperature Sensor
- Some Jumper wire

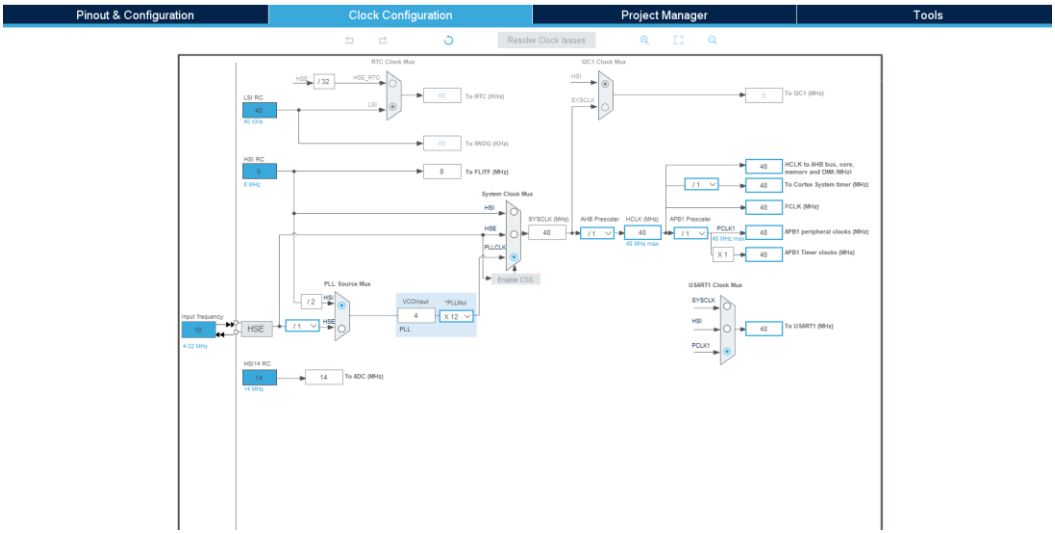
Procedure

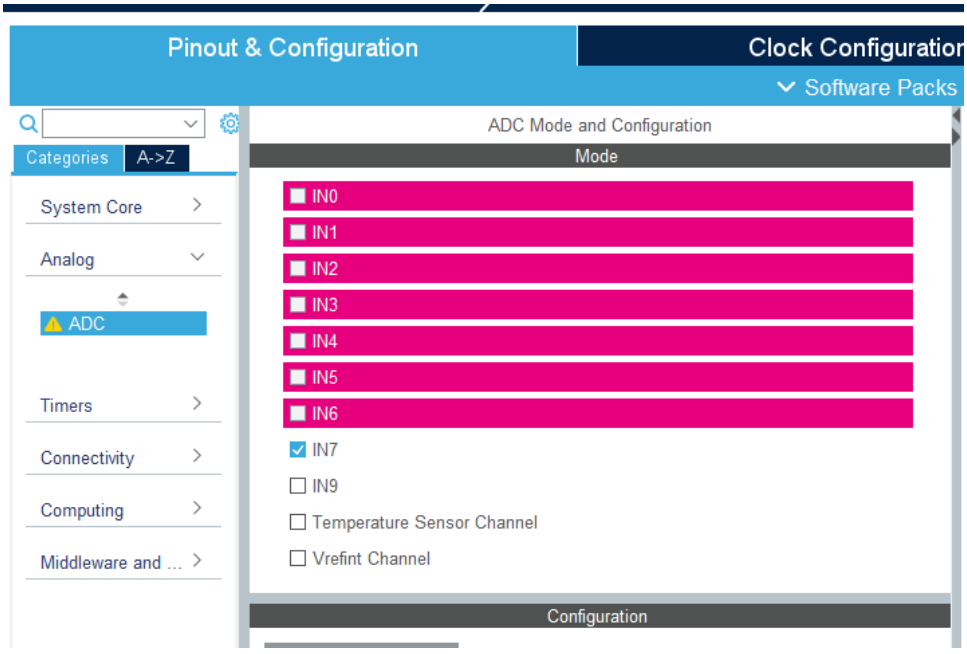
Follow the circuit diagram shown in the image given below.

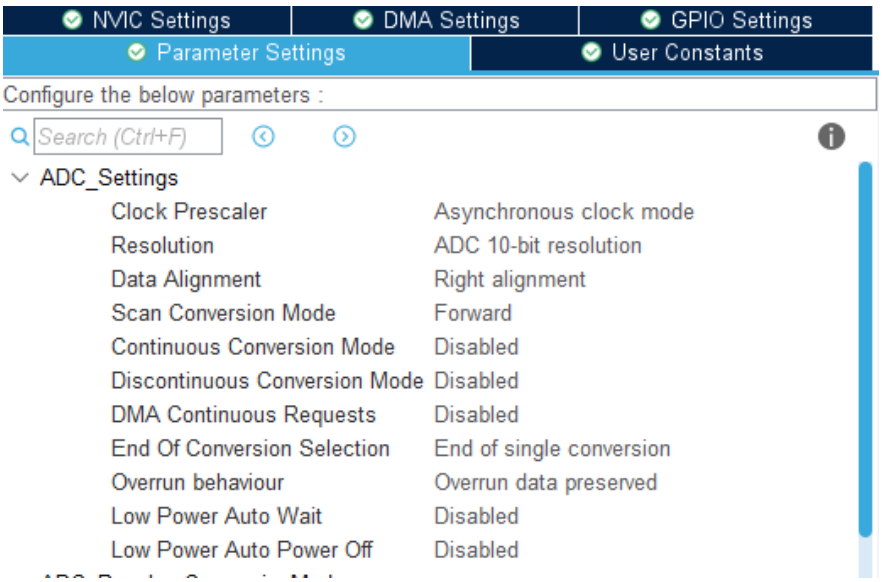


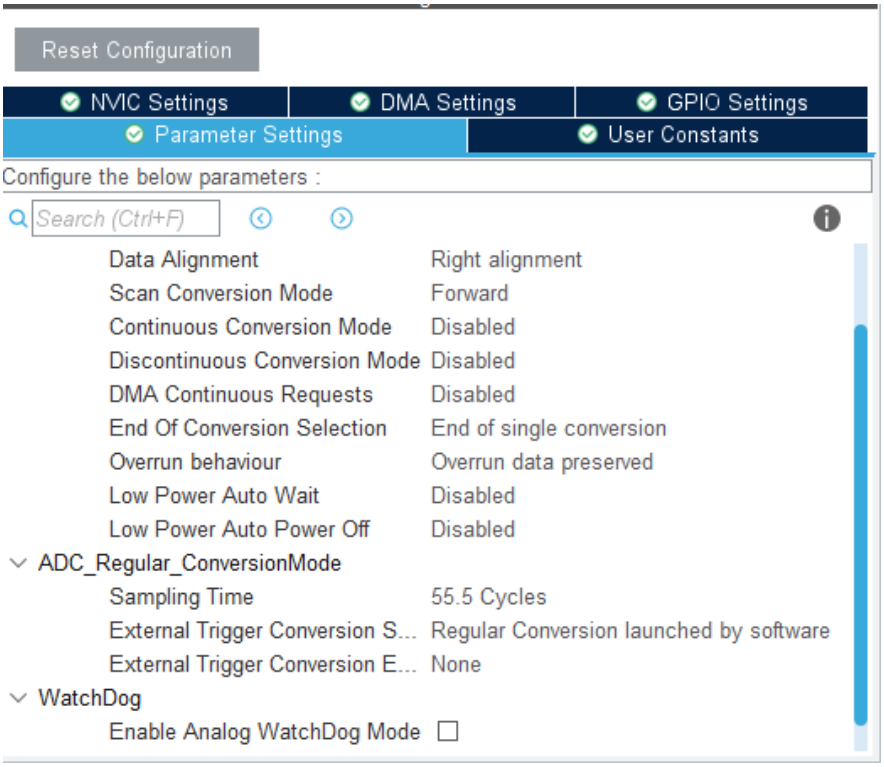
STM32F0 Pin Configuration:

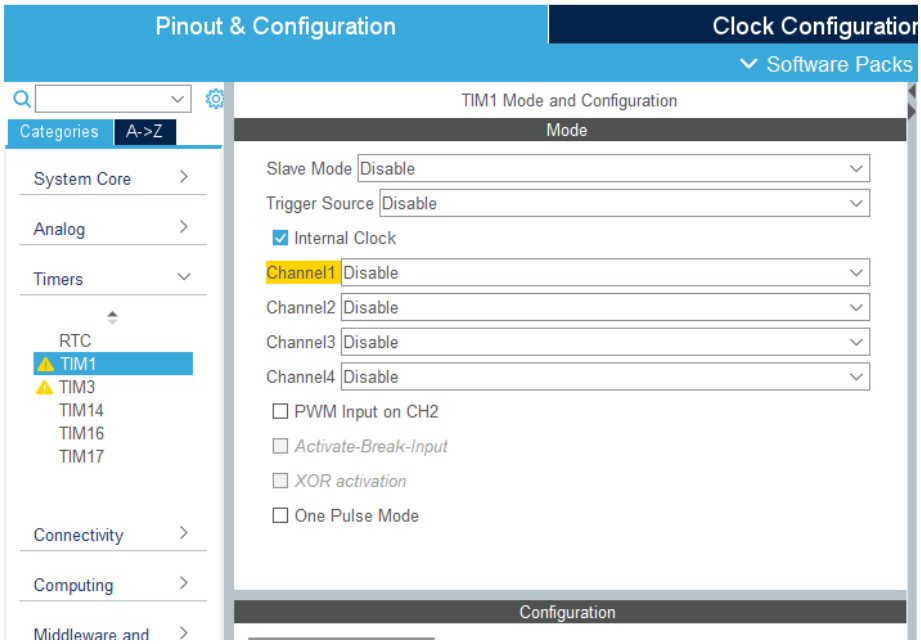


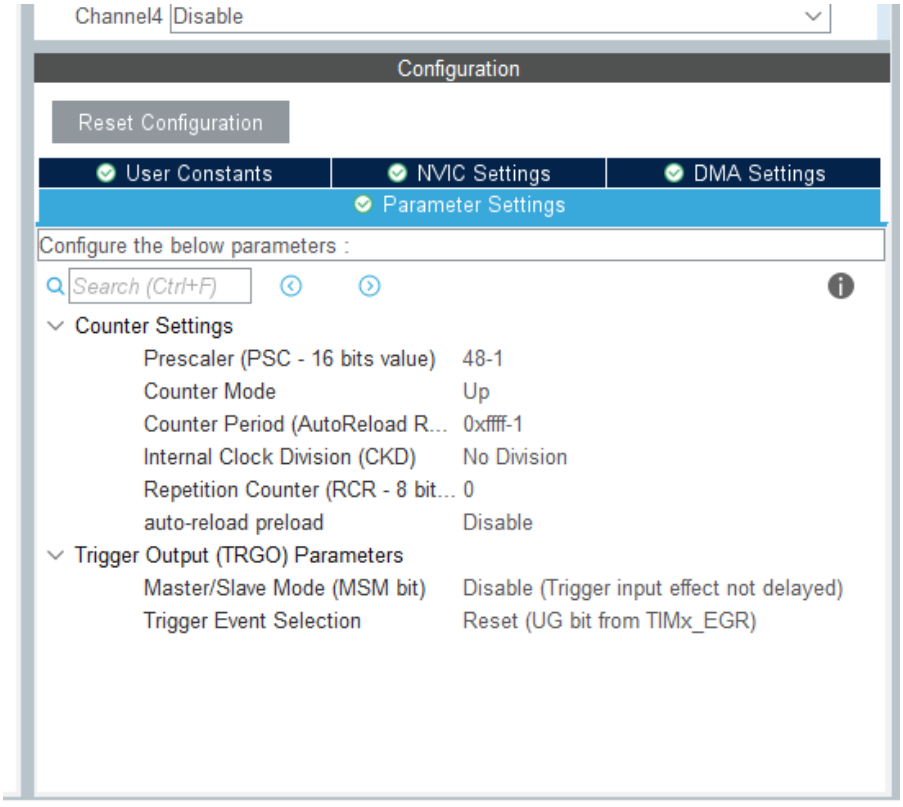




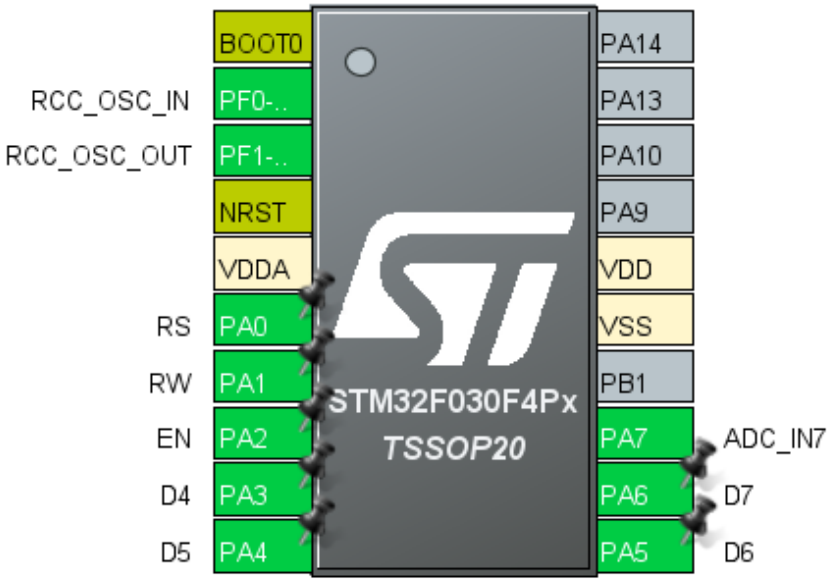

NVIC Settings
DMA Settings
GPIO Settings
Parameter Settings
User Constants
Configure the below parameters :
Search (Ctrl+F)
ADC_Settings
Clock Prescaler
Asynchronous clock mode
Resolution
ADC 10-bit resolution
Data Alignment
Right alignment
Scan Conversion Mode
Forward
Continuous Conversion Mode
Disabled
Discontinuous Conversion Mode
Disabled
DMA Continuous Requests
Disabled
End Of Conversion Selection
End of single conversion
Overrun behaviour
Overrun data preserved
Low Power Auto Wait
Disabled
Low Power Auto Power Off
Disabled


Reset Configuration
NVIC Settings
DMA Settings
GPIO Settings
Parameter Settings
User Constants
Configure the below parameters :
Search (Ctrl+F)
Data Alignment
Right alignment
Scan Conversion Mode
Forward
Continuous Conversion Mode
Disabled
Discontinuous Conversion Mode
Disabled
DMA Continuous Requests
Disabled
End Of Conversion Selection
End of single conversion
Overrun behaviour
Overrun data preserved
Low Power Auto Wait
Disabled
Low Power Auto Power Off
Disabled
ADC_Regular_ConversionMode
Sampling Time
55.5 Cycles
External Trigger Conversion S...
Regular Conversion launched by software
External Trigger Conversion E...
None
WatchDog
Enable Analog WatchDog Mode


Pinout & Configuration
Clock Configuration
Software Packs
Categories
A->Z
System Core
Analog
Timers
RTC
TIM1
TIM3
TIM14
TIM16
TIM17
Connectivity
Computing
Middleware and
TIM1 Mode and Configuration
Mode
Slave Mode Disable
Trigger Source Disable
Internal Clock
Channel1 Disable
Channel2 Disable
Channel3 Disable
Channel4 Disable
PWM Input on CH2
Activate-Break-Input
XOR activation
One Pulse Mode
Configuration


Channel4 Disable
Configuration
Reset Configuration
User Constants
NVIC Settings
DMA Settings
Parameter Settings
Configure the below parameters :
Search (Ctrl+F)
Counter Settings
Prescaler (PSC - 16 bits value) 48-1
Counter Mode Up
Counter Period (AutoReload R... 0xffff-1
Internal Clock Division (CKD) No Division
Repetition Counter (RCR - 8 bit... 0
auto-reload preload Disable
Trigger Output (TRGO) Parameters
Master/Slave Mode (MSM bit) Disable (Trigger input effect not delayed)
Trigger Event Selection Reset (UG bit from TIMx_EGR)

PA0 To PA6 Pin set as OUTPUT



Code

```
#include "LCD1602.h"
ADC_HandleTypeDef hadc;

TIM_HandleTypeDef htim1;
void SystemClock_Config(void);
static void MX_GPIO_Init(void);
static void MX_ADC_Init(void);
static void MX_TIM1_Init(void);

int32_t LM35_tmp(uint32_t ADCvalue){

       int16_t voltage  = ( ADCvalue * 33000) / 1023;

       int16_t Temp = voltage / 1;

    return Temp;
}



void Print(int32_t intd) {
  char buff[8]; // Allocate space for sign (if needed) and null terminator

  // Check for negative value and add a minus sign if necessary
  if (intd < 0) {
    buff[0] = '-';
    intd *= -1;    // Convert to positive for further processing
  } else {
    buff[0] = ' '; // Add a space for positive values to maintain alignment
  }

  buff[1] = (intd / 10000) % 10 + 48;
  buff[1] = (buff[1] == '0')? ' ':buff[1]; // Replace with space to hide front zero
  buff[2] = (intd / 1000) % 10 + 48;
  buff[3] = (intd / 100) % 10 + 48;
  buff[4] = '.';                   // Decimal point
  buff[5] = (intd / 10) % 10 + 48;
  buff[6] = intd % 10 + 48;
  buff[7] = 0; // Null terminator

  LCD_String(buff); // Send the formatted string to your LCD display function

  LCD_String(" ");
}


int32_t temp;
int32_t adcvalue;
```

```c
int main(void)
{
  HAL_Init();

  SystemClock_Config();

  MX_GPIO_Init();
  MX_ADC_Init();
  MX_TIM1_Init();
  HAL_TIM_Base_Start(&htim1);  // Timer On and init this line
  lcd_init();                //LCD init



  lcd_xy(0, 4);   // set curser postion

  LCD_String("LM35 Temp");  // Print String

  while (1)
  {


      HAL_ADC_Start(&hadc);
      HAL_ADC_PollForConversion(&hadc,200);
      adcvalue = HAL_ADC_GetValue(&hadc);
      temp =  LM35_tmp (adcvalue);

       lcd_xy(1, 4);
       Print(temp);

        lcd_xy(1, 11);
        LCD_String("\337C");  // for degree celcus

        HAL_Delay(500);
  }
}
```

Output: